

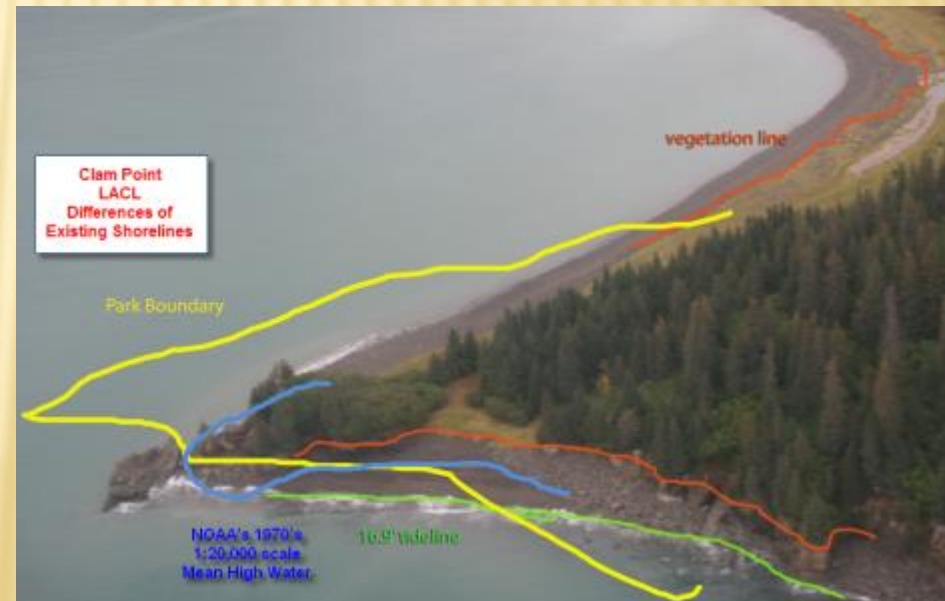
MAPPING SHORELINES ALONG COOK INLET - SHIFTING METHODS FOR THE FUTURE



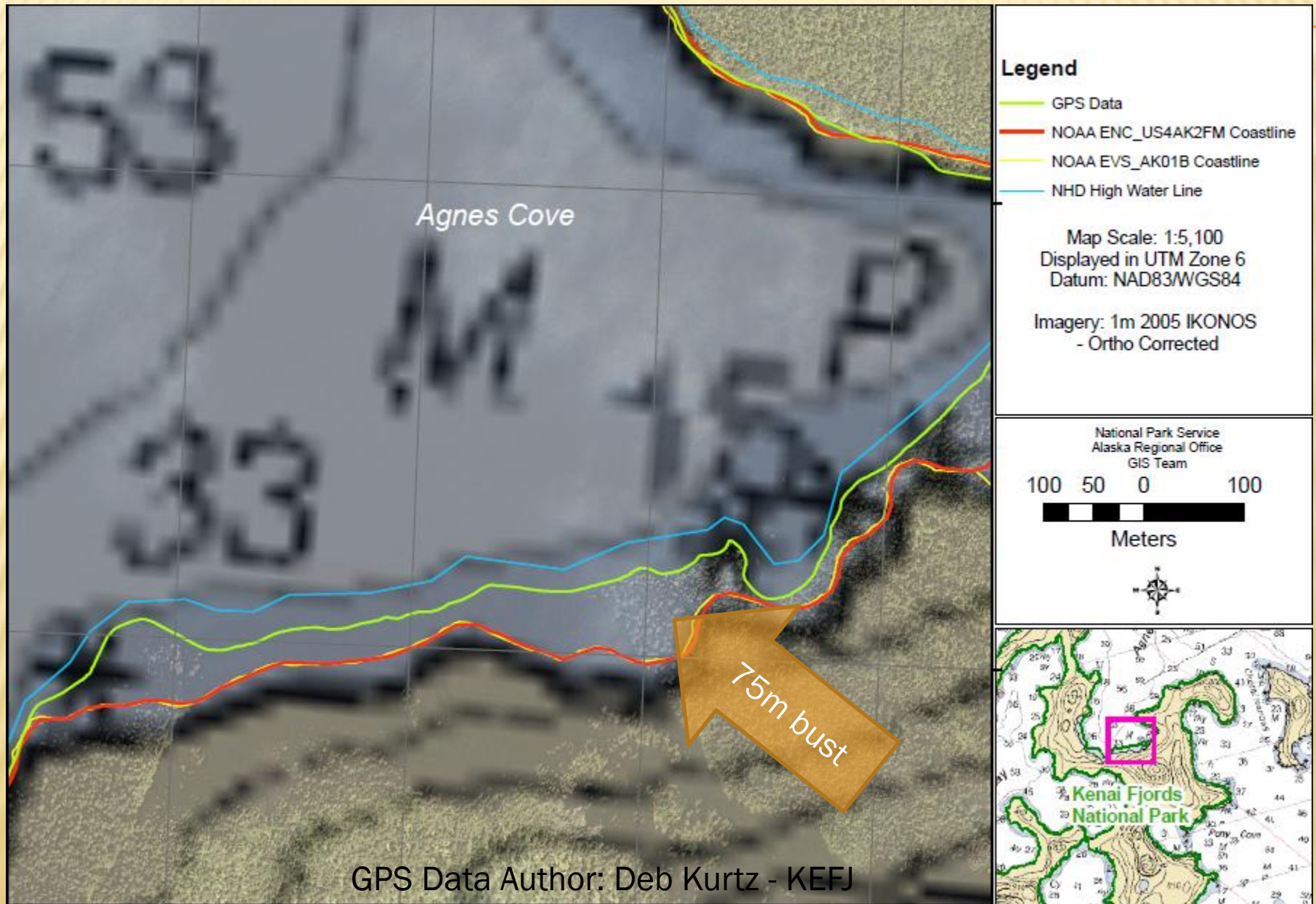
Joel Cusick
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Joel_cusick@nps.gov 644-3549

WHAT'S THE PROBLEM

- ✗ Marine shorelines in 80% of our parks are irrelevant and lack a modern tie to local water levels



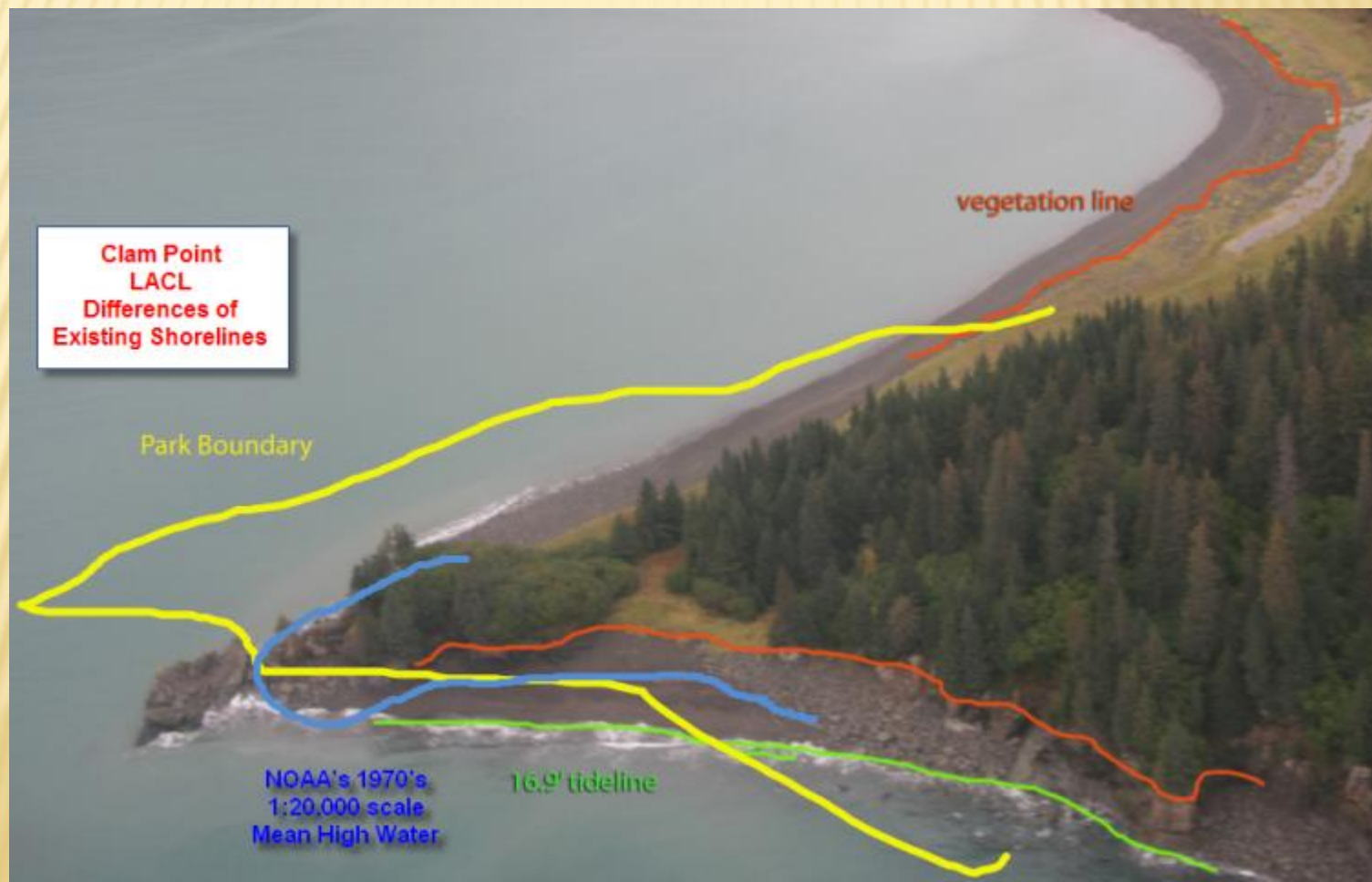
THEY ARE A HAZARD



THE DATA IS OLD AND SMALL SCALE

Park	ENC Cell Name		Charting Survey Dates	Scale
ANIA	US2AK5FM US4AK5HE US4AK5IE	1:1,023,188 1:77,477 1:106,600	1950 - 1970	1:1,023,188 1:77,477 1:106,600
BELA	US1BS03M US3AK80M	1:3,500,000 1:400,000	1950 - 2003	1:3,500,000 1:400,000
CAKR	US1BS03M US2AK92M	1:3,500,000 1:700,000	1950 - 2003	1:3,500,000 1:700,000
KEFJ	US4AK2DM US4AK2EM US4AK2FM	1:200,000 1:83,074 1:81,847	1927 - 2001	1:200,000 1:83,074 1:81,847
LACL	US4AK13M	1:100,000	1935 - 1975	1:100,000

THEY ARE AMBIGUOUS AND INCONSISTENT



THEY ARE WASTING OUR TIME AND \$

- ✗ Error-prone transects for science
- ✗ Coastal GIS datasets that inherit these lines (eg. shorezone) are spatially irrelevant



*H. Coletti, NPS

Bligh Reef – *Exxon Valdez* oil spill (1989)

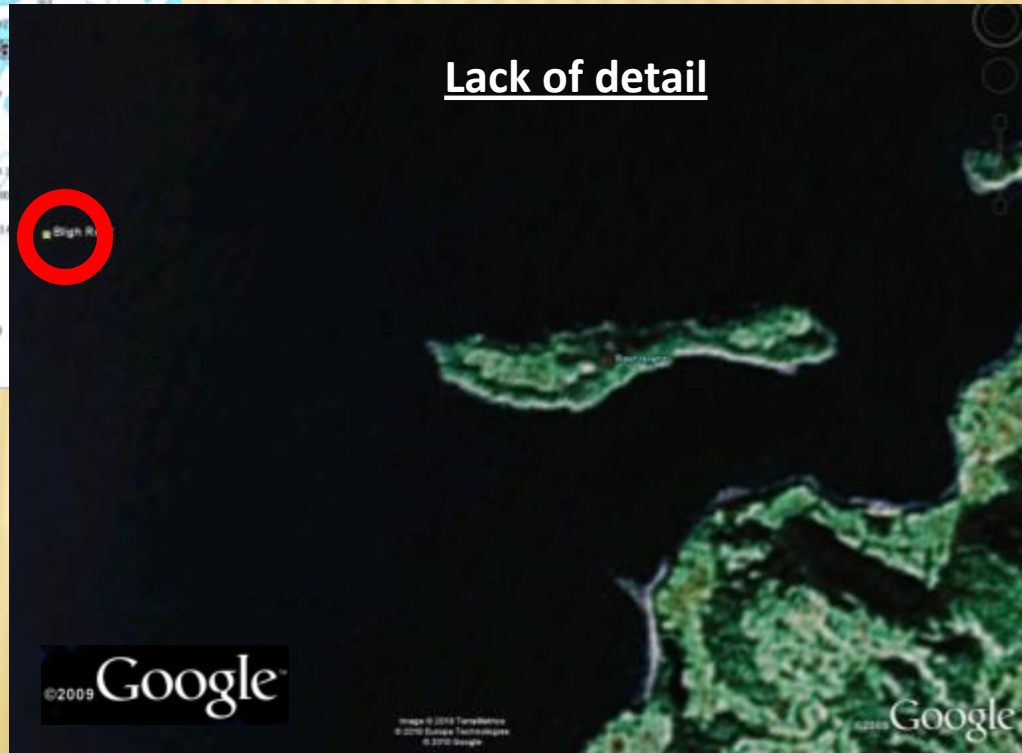
Lessons learned

Lack of baseline information:

- Shoreline, Charts, habitat maps, imagery



Lack of detail



SHORELINE MAPPING TECHNIQUES

✕ Across Shore Profiles

- + Simple, fast, Cross-section of beach face
- + Identify rates of volume addition (accretion) and subtraction (erosion)



SHORELINE MAPPING TECHNIQUES

- ✖ NOAA Coast Survey
 - + Aerial photography
 - + Local Tidal Datum Control
 - + Marine Charts
- ✖ Digital Shorelines in GIS
 - + NOAA Survey Data



SHORELINE MAPPING TECHNIQUES

- ✗ Imagery
 - + Vegetation line
 - + High Water Mark
 - + Wet/Dry Line
- ✗ Surrogates for MHW



SHORELINE MAPPING LINKED TO TIDAL DATUM

- ✖ GPS Derived Elevations and Ties to Local Tidal Datum
 - + Highly repeatable
 - + Beach changes have no effect on water level
- ✖ MHW, MHHW, Mean Tidal range etc



Tertiary Tidal Station
in place for 30 days

Vertical leveling water
levels to benchmarks



Nathan Wardwell performing staff shots to establish the vertical relationship of the gauge and the benchmarks.

August 7, 2004

WHAT'S THE DEAL WITH MHW?

- ✗ NRC Quote* “sic....the committee recommends that the internationally recognized shoreline established by the NOAA National Geodetic Survey be adopted”
- ✗ “The most challenging issue in Alaska coastal parks is understanding jurisdiction because of Mean High Water” **

*2004, National Resource Council, Ocean Studies Board, Committee on National Needs for Coastal Mapping and Charting.

**S. Hall, 20089 Proceedings of the 2009 NPS Service wide Comprehensive Ocean & Coastal Park Workshop, Establishing a community of Practice, Formulating Guidance, and charting a Course for the future, August 15-27, 2009, boulder, Colorado. Latouche Passage, PWS

LACL SHORELINE PROJECTS

- ✘ Coastal orthophoto (Completed for LACL)
- ✘ 2011 Across Shore Profile Study (In progress)
- ✘ Compile an accurate and contemporary shoreline using NOAA data (In progress)
- ✘ Re-register high res geomorphological segments with Coastal Orthophoto (Proposed)
- ✘ Map historical shoreline positions (Proposed)
- ✘ Establish GPS network along coast (Proposed)

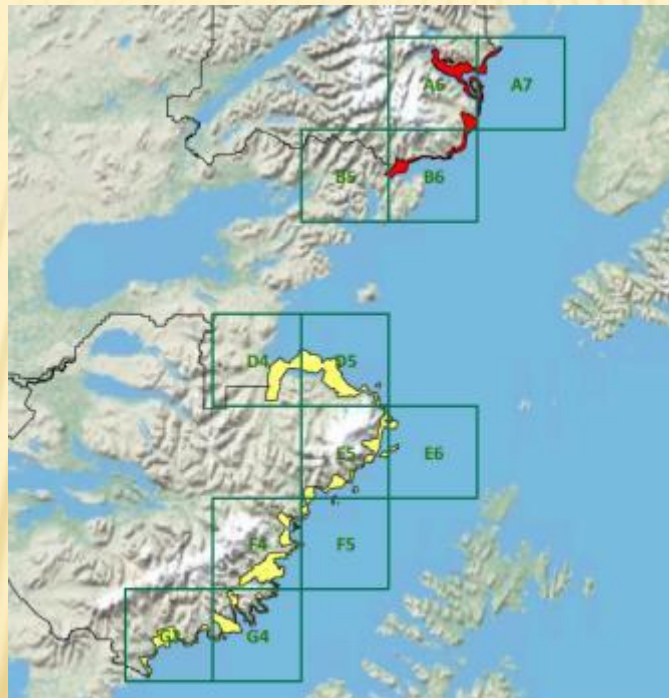
COASTAL ORTHOPHOTO STATUS – LACL/KATM

✕ LACL

- + Acquired summer 2010
- + Orthorectified and available in PDS

✕ KATM

- + 80% complete
- + Extending contract into 2012

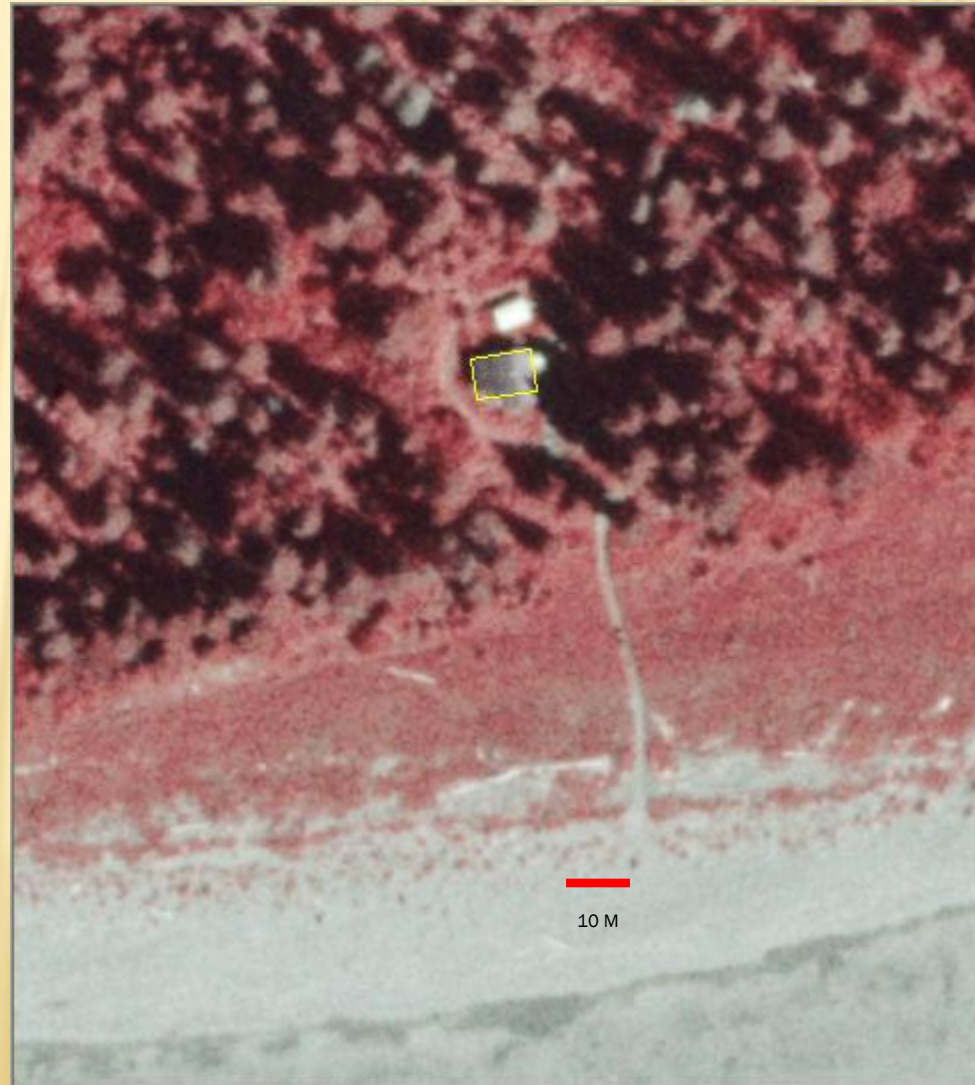


+ Deliverables

- ✕ DEM
- ✕ Scans/Contact Prints
- ✕ Index

LAKE CLARK COASTAL ORTHOPHOTO

- ✗ Tidally coordinated
 - + < +5' MLLW
- ✗ 1:24,000 scale
- ✗ GPS controlled
- ✗ Pixel < 1 meter
- ✗ Preliminary accuracy +/- 2 meters



ACROSS SHORE PROFILES

- ✖ 10 Sites (1992, 1994)
- ✖ 7 Sites (2004)
- ✖ 4 Sites (2011)



ACROSS SHORE PROFILE METHODS

- ✕ Rod and Transit (Level) Surveys
 - + Surface elevations directly measured along a draped tape to waterline



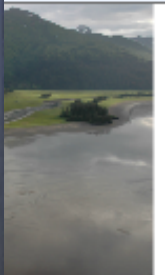
GLACIER SPIT – QUICK VIEW USING SHOREZONE



Data Dictionary



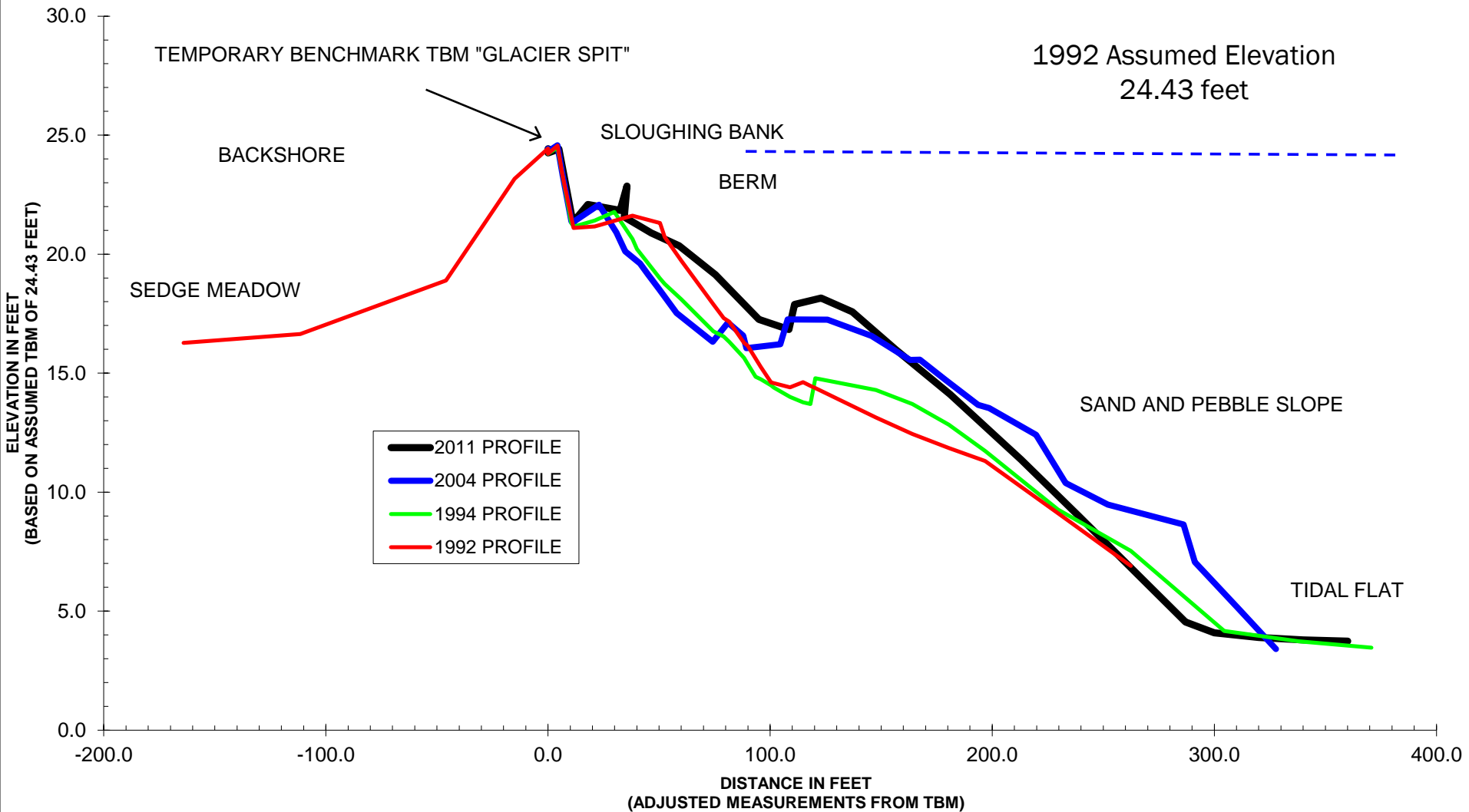
N Lon: 153° 7' 4"



<http://mapping.fakr.noaa.gov/szflex/>



SHORELINE PROFILES - 2011



E = Erosion

A = Accretion

= = Little Change

A +

A ++

= =

= =

E

Clam Point

Glacier Spit

Spring Point

Silver Salmon

Slope Mountain

Crescent River

Polly Creek

Cook Inlet



SHIFTING TO A GPS DATUM-BASED SHORELINE

- ✖ Precise –highly repeatable
 - + Relative accuracies (1cm)
- ✖ Allows for rapid assessments once control network is in place.
- ✖ ARO has 2 RTK GPS units (R8 Model 3)



GPS PROFILES



LACL_CoastalGeomorph

Chinitn

2011 FIELD RESULTS - DISCUSSION

- ✗ Profile benchmarks – good condition
- ✗ Tape and GPS data being compared
- ✗ More work being discussed
 - + Recovery of 3 northern sites – Polly, Crescent River and Slope Mountain

ACCURATE AND CONTEMPORARY COAST

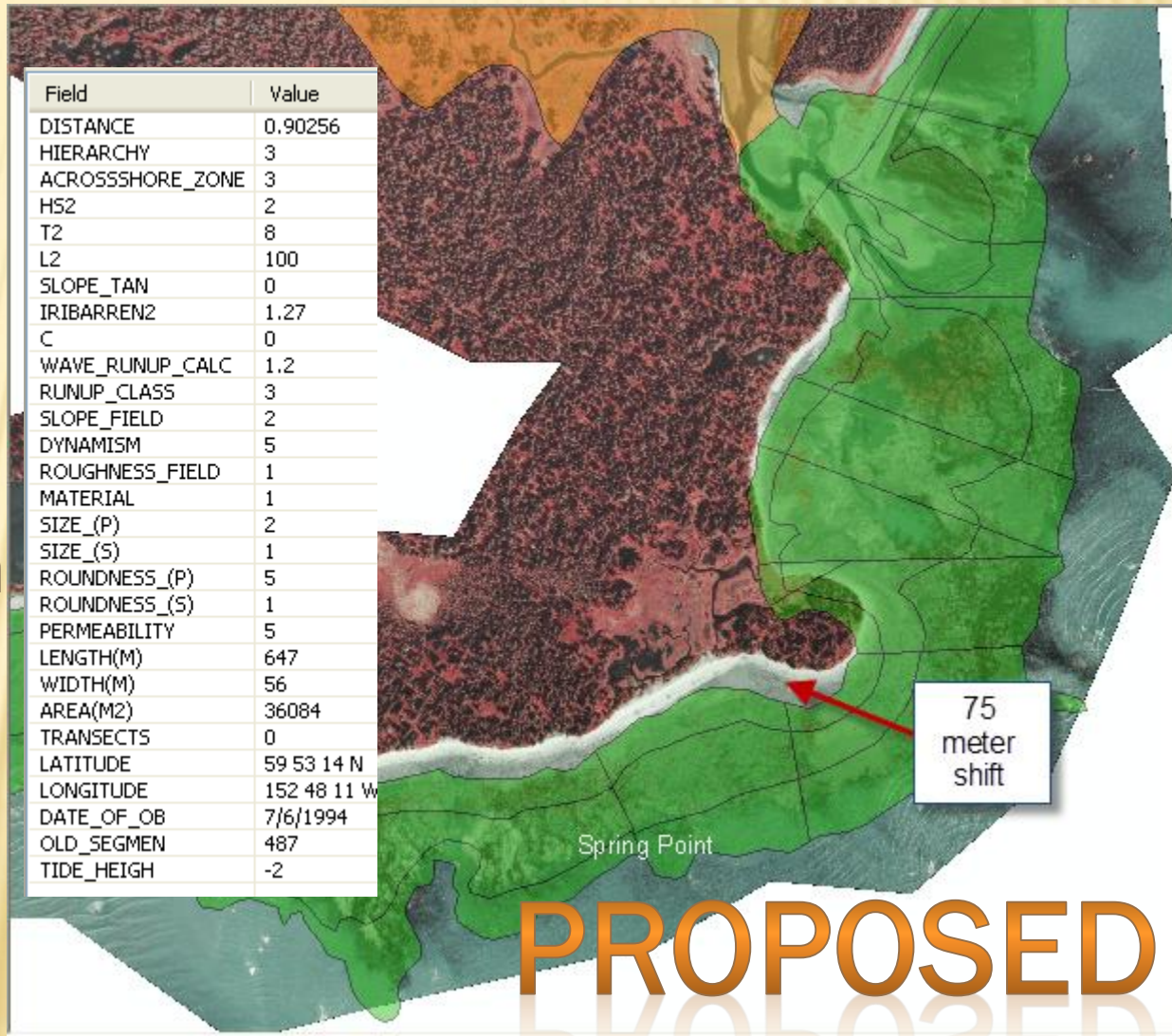
- ✕ Blue – Best available USGS coast and NPS boundary
- ✕ Red – Best NOAA MHW Data



See GIS Team Poster!

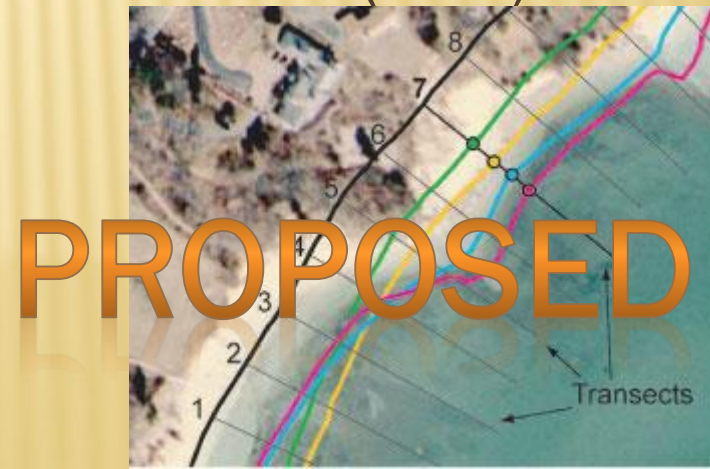
RE-REGISTER COASTAL LAYERS

- ✖ 1996
- ✖ Hi resolution across shore segments for entire coast
- ✖ Re-registration to 2010 Ortho



MAP HISTORICAL SHORELINE POSITIONS

- ✖ Co-reference historical imagery with highest resolution orthophoto
 - + 1954, 1978, 1993, 2004, 2010
- ✖ Digital Shoreline Analysis System (DSAS)
 - + ArcGIS extension for calculating shoreline change
 - + Determine a Shoreline Reference Feature (SRF)
 - + 30-50 meter spacing



CONTINUE ESTABLISHING GPS NETWORK

Backbone sites

- ✗ Permanent



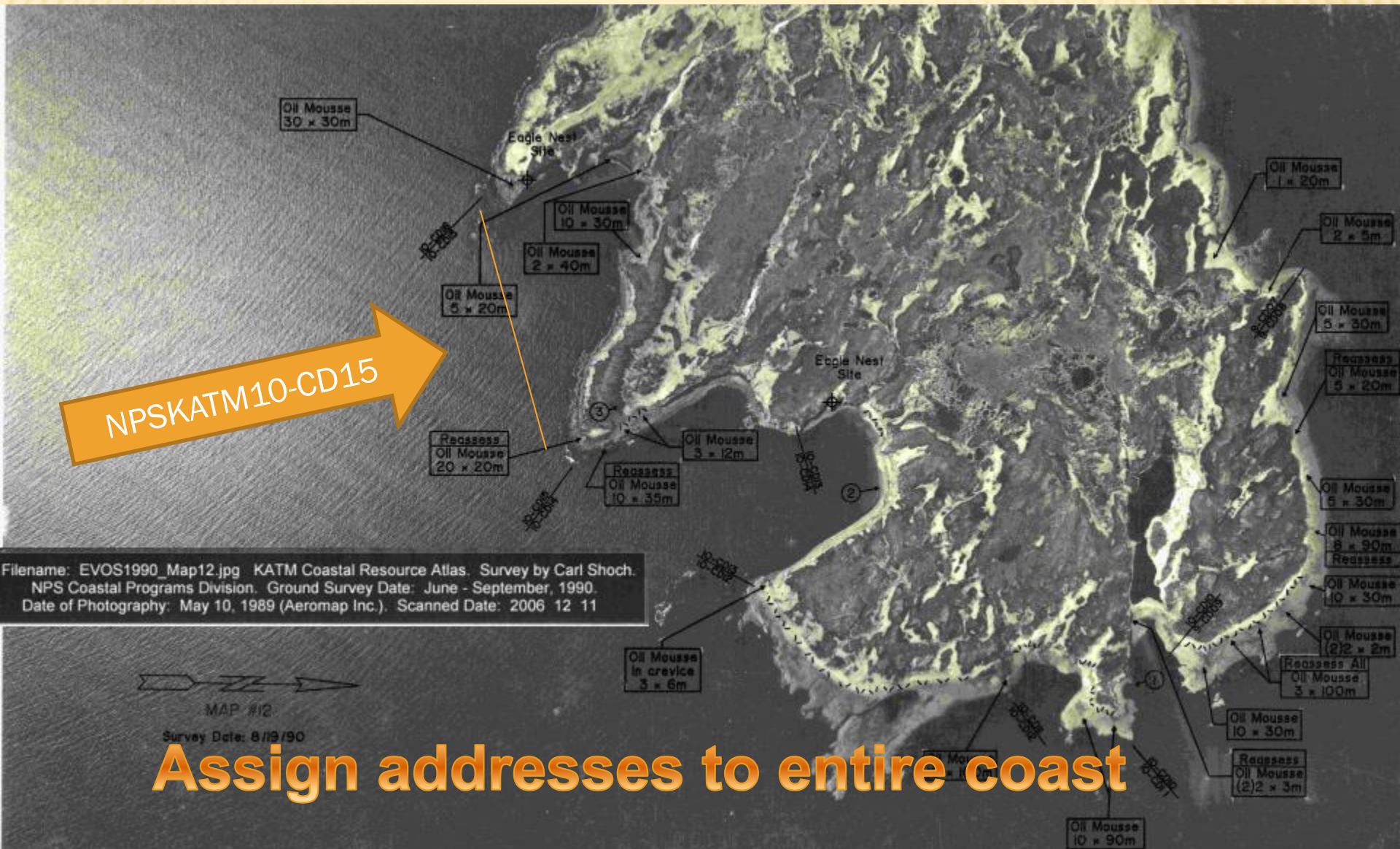
Sentinel sites

- ✗ Semi-permanent
- ✗ Hot spots along coast



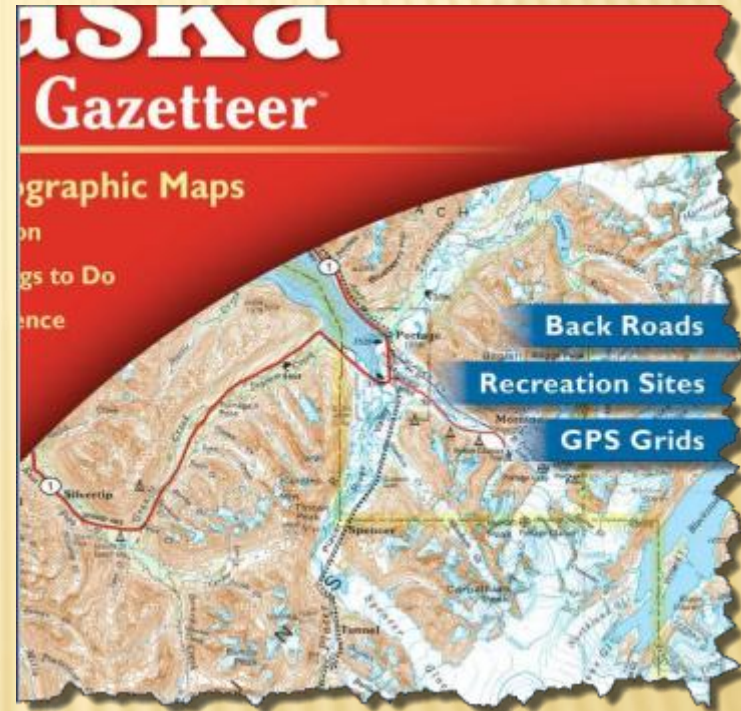
Christine.Gallagher@noaa.gov, 2011. Accurate Elevations in Coastal National Parks -Preparing and planning for impacts of climate change

KEEPING IT SIMPLE – COASTAL PHONEBOOK



CHEAP BUT EFFECTIVE FIELD TOOL - ATLAS

- ✖ Skiff/Ranger ready map product
- ✖ Resources (Bald Eagle nests etc)
- ✖ GPS Grid overlay where possible, double sided with imagery and marine chart

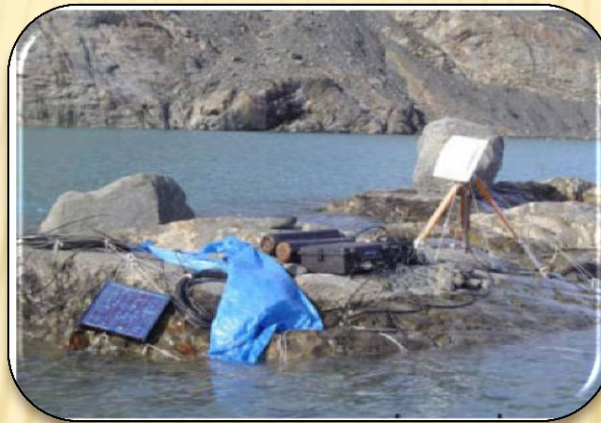


KATM – Wait till ortho arrives. ANIA, KEFJ Ready. WRST requires ortho.

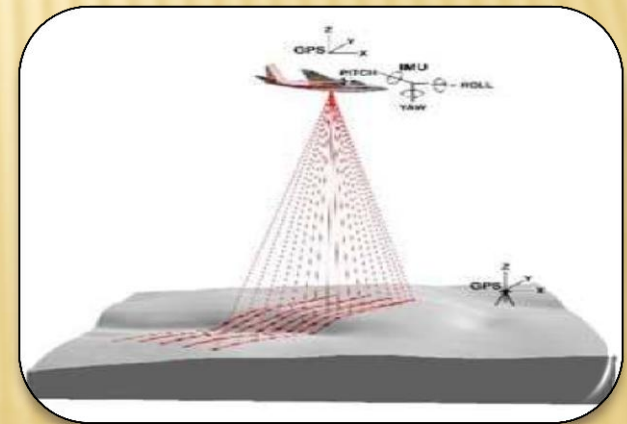
LOOKING TO THE FUTURE



Build GPS
Backbone



Tidal Stations



LiDAR

INSTALL TIDAL GAUGES



- ✘ Tertiary tide gauge ~\$30K
 - + Temporary installation (30-50 days)
 - + Use existing NOS Control
- ✘ Partner Up
- ✘ Tidal Power projects in Cook Inlet*



* Kris Holderied / Amy Holman (NOAA)

SUMMARY

ACKNOWLEDGMENTS

Chuck Lindsay (SWAN)

Warren Hill (Boat Pilot LACL)

Randy Schrank (Surveyor, USFS Chugach)

Michael Shephard (SWAN Network Coordinator)



Questions?

